

A List of the Species of *Ceratium* in Japan.

BY

K. Okamura and T. Nishikawa.

With Plate VI.

The following annotated list of *Ceratium* found in the seas around Japan was drawn up chiefly from the notes and figures taken by T. Nishikawa from among the plankton material collected at several places by instigations of the Imperial Fisheries Bureau of the Japanese government.

The task of identification had devolved upon K. Okamura, who also had opportunities of independently collecting and studying some species on the coast of Prov. Bōshyū.

Owing to our want of access to certain necessary reference papers, we have been compelled to leave undecided the systematic status of some of the forms but to mark them either with query or as provisionally new.

The references given under each of the forms are only those which could have been consulted by us.

Ceratium tripos Duj.

(Fig. 1).

Cleve, '02, p. 28.—'01, p. 231.—'97 *a*, p. 301, fig. 1, (typical *C. tripos*).—'97 *b*, p. 26. (*C. tripos* Nitzsch.).

Gourret, '83, p. 23 (*C. tripos* Nitzsch.).

Hensen, '87, Taf. VI, fig. 57.

Schütt, '93, p. 266, fig. IV, *a* (without name).

Schröder, '01, p. 15, Taf. I, fig. 17 *a* (*C. tripos* Nitzsch.).

Gran, '02, p. 193 (*C. tripos* [O. F. Müller] Vanh.).

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).
 Other known loc.: Temperate Atlantic; North sea; Sweden.

Ceratium macroceros Ehb.

(Fig. 2).

Cleve, '02, p. 27.—'01, p. 227.—'97, *a*, p. 301, fig. 6.—'97 *b*, p. 26.

Gran, '02, p. 194.

Schröder, '01, p. 15, Taf. 1, fig. 17, f-g. (*C. tripos* var. *macroceras* Ehrbg.).

Schütt, '93, p. 266, fig. IV C. (without name).

Hensen, '87, Taf. VI, fig. 58.

Gourret, '83, p. 26, Taf. 2, fig. 41 (*C. tripos* var. *macroceros* Ehrbg.).

Loc. in Japan: Kushimoto in Prov. Kii; Awomori in Prov. Mutsu.
 (Nishikawa coll.).

Other known loc.: The Atlantic; the Mediterranean; German Ocean; coast of Norway to Finmark; Sweden.

Ceratium (tripos var.) *arcuatum* Gourret.

(Figs. 3, 3*a*, 4, 5(?)).

Gourret, '83, p. 25, Pl. II, fig. 42.

Cleve, '02, p. 24.—'01, p. 208.—'00 *a*, p. 13, Pl. VII, fig. 11.

Schröder, '01, p. 15.

—Granted our identification is correct, this species seems to be subject to considerable variations in external appearance, as may be seen from the figures we have given. We are somewhat in doubt if the individual represented in fig. 5 does not belong to *C. tripos* var. *longipes* Bail.

Loc. in Japan: Kushimoto in Prov. Kii. (T. Nishikawa coll.).

Other known loc.: Tropical Atlantic between 29°S. and 48°N., where the species is rather common.

Ceratium flagelliferum Cl.

(Figs. 6, 7).

Cleve, '00 *a*, p. 14, pl. VII, fig. 12.—'02, p. 26.—'01, p. 217.—'99, p. 3, (*C. tripos* var. *flagellifera* (n. v.)).

Schröder, '01, p. 16, pl. I, fig. 17 h, (*C. tripos* var. *macroceras* f. *inflexa* (Gourr.) nov. forma).

Gourret, '83, p. 29, pl. III, fig. 44, (*C. tripos* var. *inflexum*).

We refer the specimens to this species, since the antapical horns exhibit tendency to show the characteristic flexure.

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.); Shirahama in Prov. Bōshū (K. Okam. coll.).

Other known loc.: Common in tropical and subtropical Atlantic between Africa and S. America, ranging from 29°S. to 45°N.

Ceratium flagelliferum var. **filiformis** nov. var.

(Fig. 11).

This variety, characterized by the slenderness and flexibility of all the horns, had been only once observed by T. Nishikawa at Wajima in Prov. Noto, where the *Tsushima* current, a branch of the warm *Kuroshio*, takes its course. The flexibility of the horns manifested itself by the motion shown by them in the mounting liquid on a slight touch to the cover-glass. We propose to call this form, which we provisionally consider as a variety of *C. flagelliferum*, by the name of *filiformis*, since we are not quite sure if the flexibility and slenderness of the horns can be regarded to be constant or not.

Loc. in Japan: Wajima in Prov. Noto (T. Nishikawa coll.).

Ceratium (tripos var.) **vultur** Cl.

(Fig. 8).

Cleve, '00 *a*, p. 15, pl. VII, fig. 5.—'02, p. 29.—'01, p. 234.

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.);

Shirahama in Prov. Bōshū (Okam. coll.).

Other known loc.: Indian Ocean and tropical Atlantic between
21°S. and 45°N.

***Ceratium contortum* Gourret.**

(Fig. 9).

Cleve, '00 *a*, p. 14, Pl. VII, fig. 10.—'02, p. 25.—'01, p. 213.

Schütt, '93, p. 268, fig. VII *b*. (without name).

Gourret, '83, p. 35, Pl II, fig. 33 (*C. Gibberum* var. *contortum* Gourr.).

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).

Other known loc.: The Mediterranean Sea and the Indian and
Pacific Oceans; tropical parts of the Atlantic; E. of S. Ame-
rica and W. of Africa.

***Ceratium platycorne* v. Daday.**

(Fig. 10).

Cleve, '02, p. 28.—'01, p. 229.—'97, p. 26, Pl. 2, fig. 29 (*C. tripos* var.
aurita Cl.).

Schröder, '01, p. 15 (*C. tripos* var. *platycornis* (Daday) Lemmerm.).

Schütt, '93, p. 269, fig. IX a-b (without name).

Loc. in Japan: Shirahama in Prov. Bōshū (Okam. coll.).

Other known loc.: E. Atlantic between the Azores and the Eng-
lish Channel; Gulf of Naples.

***Ceratium ranipes* Cl.**

(Fig. 12).

Cleve, '00 *a*, p. 15, Pl. VII, fig 1.—'01, p. 230.

Schröder, '01, p. 16, Taf. I, fig. o—p (*C. tripos* var. *macroceras* f. *palmata*
Schröd.).

Schütt, '93, p. 269, fig. VIII a—b, (without name).

Our specimen does not agree exactly with any of the figures given in the references quoted above; but by comparing those figures with one another, we find that the curvature of palmated horns and the number of digits are not constant. Consequently, we refer our Ceratium to this species, though the characters of Schütt's *Ceratium digitatum* (Cleve, '01, p. 215) are not known to us, owing to the regrettable fact that Schütt's Die Peridineen d. Plankton-Expedition, in which that species should stand described, is not accessible to us.

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).

Other known loc.: Tropical Atlantic: in the Equatorial, the Antilles and the Florida current; around the Azores;—in fact, between 12° and 49° N.

Ceratium (tripos var.) *bucephalum* Cl.

(Fig. 13).

Cleve, '02, p. 25.—'01, p. 211.—'97 a, p. 302, fig. 5.—'97 b, p. 26.

Gran, '02, p. 194. (C. bucephalum Cl.).

Loc. in Japan: Awomori in Prov. Mutsu (T. Nishikawa coll.).

Other known loc.: The Atlantic, extending as far south as lat. 36°2'N. and to Finmark in the north; the German Ocean; Sweden.

Ceratium arcticum (Ehb.) Cl.

(Fig. 14).

Cleve, '01, p. 207.—'97 a, p. 302, fig. 3 (C. tripos var. arctica Ehb.)—'97 b, p. 26.

Gran, '02, p. 196; p. 46, fig. 3; p. 193 (C. (macroceros subsp.) arcticum (Ehb.) Gran).

Schütt, '93, p. 308 (C. tripos var. labradorica Schütt).

Loc. in Japan: Awomori in Prov. Mutsu (T. Nishikawa coll.).

Other known loc.: Arctic Ocean: Baffin's Bay, Davis Strait, Labrador-Current.

***Ceratium furca* Duj.**

(Fig. 15).

Cleve, '02, p. 26.—'01, p. 218.—'97 *a*, p. 301.—'97 *b*, p. 25.

Schröder, '01, p. 17.

Hensen, '87, Taf. VI, fig. 63-64.

Gourret, '83, p. 50—51. Pl. IV, fig. 60—62 (*C. furca* var. *singularis*, var. *tertia* and var. *media* Gour.)

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.); Shirahama in Prov. Bōshyū (Okam. coll.).

Other known loc.: The Atlantic and the Mediterranean.

***Ceratium belone* Cl.**

(Fig. 16).

Cleve, '02, p. 25.—'01, p. 211.—'00 *b*, p. 13, Pl. VII, fig. 13. (*C. [furca* var. ?] *belone* cl.).

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).

Other known loc.: W. and E. tropical Atlantic.

***Ceratium furca* var. ?**

(Fig. 17).

Schütt, '93, p. 266, fig. 76 III?

Bütschli, '81, Taf. LIII, fig. 8?

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).

***Ceratium furca* var. ?**

(Figs. 18, 19).

Gourret, '83, p. 46, Pl. IV, fig. 63?

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.); Bōshyū (Okam. coll.).

Ceratium gravidum Gourr.

(Fig. 21).

Cleve, '02, p. 27.—'01, p. 222.

Schütt, '93, p. 269, fig. X *a-b*, (without name).

Gourret, '83, p. 58, Pl. I, fig. 15.

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).

Other known loc.: Mediterranean Sea; Indian Ocean; the Atlantic.

Ceratium lineatum Ehb.

(Fig. 20).

Cleve, '02, p. 27.—'01, p. 224.

Gran, '02, p. 193 and p. 197.

Schütt, '93, p. 266, fig. II?

In reference to the diagnosis given by Gran and to the figure of *C. lineatum* var. *robusta* given in Cleve ('00 *b*, p. 925, fig. 6), we have referred the specimens to this species, but we are not certain whether they represent the typical species or a variety.

Loc. in Japan: Kushimoto in Prov. Kii (T. Nishikawa coll.).

Other known loc.; the Atlantic.

Ceratium fusus Duj.

(Figs. 22, 23).

Cleve, '02, p. 26.—'01, p. 220.—'97 *b*, p. 26.

Gran, '02, p. 197.

Schütt, '93, p. 266, fig. I; p. 309, fig. IX.

Gourret, '83, p. 54, Pl. IV, fig. 66? (*C. pellucidum* Gourr.).

Bütschli, '81, Taf. LIV, fig. 2a.

As shown in our fig. 22, the rudimentary horn is almost on the verge of disappearance, making the general appearance approach that of Gourret's fig. 66.

Loc. in Japan : Kushimoto in Prov. Kii, and Awomori in Prov. Mutsu (T. Nishikawa coll.).

Other known loc. : W. Coast of Africa ; Iceland ; the Farøe Channel ; Norway ; Beeren Island.

***Ceratium fusus* var. *concava* Gourr.**

(Fig. 24).

Gourret, '83, p. 53, pl. IV, fig. 64.

Loc. in Japan : Awomori in Prov. Mutsu (T. Nishikawa coll.).

Other known loc. : Probably same as those of the typical species.

***Ceratium fusus* var. *stricta* nov. var. prov.**

(Fig. 25).

This variety is characterised by the angular flexure of the left horn at its origin and by the straightness of all the horns. We regret that we are not able to obtain an exact idea as to the characters of *C. (fusos var.) geniculatum* Lemm.) as Lemmermann's Abb. d. Naturw. Ver. Bremen, Bd. XVI, H. 2, does not stand at our disposal.

Loc. in Japan : Kushimoto in Prov. Kii (T. Nishikawa coll.).

Literature consulted.

- Bütschli, O.** '81. Protozoen. **Bronn's** Klassen u. Ordnungen, 1. Bd.
- Cleve, P. T.** '97 *a.* Report on the phytoplankton collected on the expedition of H. M. S. "Reserch," 1896. —15th Ann. Rep. Fishery Board, Scotland. Pt. 3.
- " " " '97 *b.* A treatise on the phytoplankton of the Atlantic and its tributaries.
- " " " '99. Plankton collected by the Swedish expedition to Spitzbergen in 1898.—Kongl. Sv. Vetens. Akad. Handl. Vol. 32, No. 3.
- " " " '00 *a.* Notes on some Atlantic Plankton organisms. —Kongl. Sv. Vetens. Akad. Handl. Vol. 34, No. 1.
- " " " '00 *b.* Plankton from the southern Atlantic and the southern Indian Ocean. —Kongl. Vet. Akad. Förhandl.; 1900, No. 8.
- " " " '01. The seasonal distribution of Atlantic plankton organisms.
- " " " '02. Additional Notes on the seasonal distribution of Atlantic Plankton Organisms.
- Gourret, P.** '83. Sur les Périдиниens du Golfe de Marseille.—Ann. Mus. Hist. Nat. Marseille; t. 1.
- Gran, H. H.** '02. Das Plankton des Norwegischen Nordmeeres. —Rep. on Norwegian Fishery-and Marine Investigations; Vol. 2, No. 5.
- Haeckel, E.** '90. Planktonstudien.—Jen. Z. Naturw.; Bd. 25.
- Hensen, V.** '87. Über die Bestimmung des Planktons oder des im Meere treibenden Materiales an Pflanzen

- und Thieren.—5te Ber. Comm. Wiss.
Unters. D. Meere, Kiel.
- Klebs, G. '84. Ein kleiner Beitrag zur Kenntniss der Peridineen.—Bot. Zeit., Jhrg. 42.
- Schröder, B. '01. Das Phytoplankton des Golfes von Neapel
nebst vergl. Ausblicken auf das des Atlantischen Oceans.—Mitth. Zool. Stat.
Neapel. Bd. 14.
- Schütt, F. '93. Das Pflanzenleben der Hochsee.—Reisebeschreibung der Plankton-Expedition.
- „ „ '96. Peridinales und Bacillariales.—Engler u. Prantl:
Die natürl. Pflanzenfam. Lief. 143-145.
- Vanhöffen, E. '96. Das Genus Ceratium.—Zool. Anz.; Bd. 19.
- „ „ '97. Peridineen und Dinobryon.—Bibl., Bot., Heft
42.
-

Explanation of Pl. VI.

Fig. 1.	<i>Ceratium tripos</i> Duj.	Kushimoto.	× 220.
„ 2.	<i>C. macroceros</i> Ehb.	„	× 140.
„ 3.	<i>C. (tripos var.) arcuatum</i> Gourr.	„	× 140.
„ 3 a.	<i>C. „ „ „ „ „</i>	„	× 220.
„ 4.	<i>C. „ „ „ „ „</i>	„	× 140.
„ 5.	<i>C. (tripos var.) arcuatum</i> Gourr. or <i>C. longipes</i> Bail.?		
		Kushimoto.	× 220.
„ 6.	<i>C. flagelliferum</i> Cleve.	Kushimoto.	× 220.
„ 7.	<i>C. flagelliferum</i> Cleve.	Bōshyū.	× 91.
„ 8.	<i>C. (tripos var.) vulture</i> Cleve.	Kushimoto.	× 140.
„ 9.	<i>C. contortum</i> Gourr.	„	× 220.
„ 10.	<i>C. platycorne</i> v. Daday.	Bōshyū.	× 220.
„ 11.	<i>C. (flagelliferum var.) filiformis</i> Okam. nov. var.		
		Wajima.	× 220.
„ 12.	<i>C. ranipes</i> Cleve.	Kushimoto.	× 390.
„ 13.	<i>C. (tripos var.) bucephalum</i> Cleve.	Awomori.	× 220.
„ 14.	<i>C. arcticum</i> (Ehb.) Cleve.	„	× 220.
„ 15.	<i>C. furca</i> Duj.	Kushimoto.	× 390.
„ 16.	<i>C. belone</i> Cleve.	„	× 220.
„ 17.	<i>C. furca</i> var.?	„	× 390.
„ 18.	<i>C. furca</i> var.?	Bōshyū.	× 140.
„ 19.	One of the two represented in fig. 18, highly magnified		
		Bōshyū.	× 220.
„ 20.	<i>C. lineatum</i> Ehb.	Kushimoto.	× 140?
„ 21.	<i>C. gravidum</i> Gourr.	„	× 220.
„ 22.	<i>C. fusus</i> Duj.	„	× 390.
„ 23.	<i>C. fusus</i> Duj.	Awomori.	× 220.
„ 24.	<i>C. fusus</i> var. <i>conceivum</i> Gourr	„	× 220.
„ 25.	<i>C. (fusum var.) strictum</i> Okam. nov. var. provis		
		Kushimoto.	× 140.